Report on the OFDA-sponsored Coulomb 2.0 Earthquake Software Training Course Given 10-11 September, 2001, at Bilkent University, Turkey, by Ross Stein (*USGS*) and Shinji Toda (*Geological Survey of Japan*)

Summary. We were able to accommodate 16 students on the fourteen state-of-the-art Bilkent Mac's and two we brought with us. Attendees included graduate students, researchers and professors from Bogaziçi University, Istanbul Technical University, Istanbul University, and TUBITAK (the Turkish NSF); and Officer-scientists from the General Command of Mapping. The course was led by Ross Stein, with his computer screen projected on the wall for the students to see (upper right in the photo below). Shinji Toda, the principal programmer for Coulomb, worked behind the students. Shinji could watch their screens and give individual attention to anyone who needed help, even if they were too timid to ask. He could also gage when Ross was moving too fast or when a key point was missed. In this way, nobody would fall behind or become frustrated, and everyone could compare his or her screen to Ross'. Students could also follow along in their copy of the bound color Coulomb 2.0 User Guide. Students were encouraged to ask questions and pose spontaneous 'what-if' experiments that we performed together. This led to a lively interchange and a torrent of good ideas for research.

Ross spoke from the front to the group while Shinji worked the central aisle assisting individuals.

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What follows is a brief summary of the Course questionnaires, which were emailed to participants two days after the course was completed, and a listing of the participants. Questionnaires could be submitted anonymously by email to Nancy Sandoval at the USGS; 14 out of 16 were received as of 2 October 2001.

I. Five questions were scored by students with the following numerical scale:
5 = Excellent; 4 = Very good; 3 = Good; 2 = Fair; 1 = Poor.
Below are averages tallied by Nancy Sandoval:

1. How well was the course taught by Ross and Shinji?
Score **4.9** (Excellent)
2. How were the course pacing, and responsiveness to students' questions and problems?
Score **4.6** (Excellent-Very good)
3. How useful will Coulomb be to your research?
Score **3.5** (Very good-Good)
4. How useful will Coulomb be to your teaching?
Score **4.0** (Very good)
5. How useful are the Users Guide and tutorial files?
Score **4.3** (Very good)

Course participants and teachers, manuals in hand, at the completion of the class

II. Four questions solicited written comments, which are summarized below. Full answers from all respondents are given in the appendix.

1. *What suggestions do you have for improving our teaching of the course?*

"Not many, but you had better talk about what happens behind the screen. I mean the philosophy of calculation." "More discussion on the basic principles of Coulomb approach." "Your teaching is really good. And also your speech was so clear. No problem with understanding. The only problem in this course was time. One and a half days was not enough for me to catch the Coulomb." Students wanted more theoretical background. All of our methodology papers are online at our web site. But we could include a theoretical component by adding another half to full day to the course. Students appreciated examples of Turkish faulting problems, but wanted still more. So we are putting all of our Turkish fault and earthquake input files online, without any restrictions.

Everyone performing a calculation together (unused Mac's are too old to be used for Coulomb)

2. *What suggestions do you have for improvements in the Coulomb software?*

There was a near-unanimous desire for a PC version of Coulomb. "It should be ported to the PC platform." "The version we used was quite capable and user-friendly despite a few minor problems. But a PC version is a must (at least for Europeans)." "My suggestion is related to preparing a version of Coulomb that will work under PC, since especially Macintosh is rarely used in our faculty." The widespread availability of PC's makes this far and away the favored platform. We spend considerable time just updating Coulomb for the Macintosh. Because of the heavy reliance on the Mac graphical interface, major rewriting of the code would be needed to port it to PC's, UNIX, or Linux. We can not do this without abandoning our research, or engaging a Mac/PC programmer.

3. *Could you teach Coulomb to others at your institution after some more practice?*

We offered to provide bound color manuals and CDs to anyone who would like to teach Coulomb in Turkey. Responses were very positive. "Absolutely." "Yes, I am willing to do so, very soon for our graduate students at Kandilli." "I think I can do it after some practice." "I believe that I can teach Coulomb 2.0 easily, but I may not be able to answer questions from the students about 'deep' theoretical details as Ross answered during the class."

4. *Other Comments?*

"The time we spent in Ankara was really very fruitful and enjoyable. Thanks again for everything." "Thank you so much to Ross and Shinji for organizing such a nice course. I appreciated it so much. And I hope such activities continue in the future." "Thank you and Shinji for sharing your knowledge on Coulomb with us!"

III. Course Participants

	Name	email	Institution
1	Mine Betul Demircioglu	minebd@ttnet.net.tr	Kandilli Observatory
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15	Ali Osman ONCEL	oncel@hotmail.com	Istanbul University
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Appendix: Full answers to questions soliciting comments:

1. What suggestions do you have for improving our teaching of the course?

The teaching of the course should be carried out on national faults to draw the student's attention. The theoretical background should be given to the students at least as a booklet.

The theoretical background of the software may be explained in more detail. Especially, the Coulomb Law should be explained in more detail (in the scheme and in the text format).

More discussions on the basic principles of Coulomb approach.
More discussions on recent developments about the Coulomb approach.
More discussions on shortcomings, or existing criticisms about the Coulomb approach.
More example with local data.

The theoretical background of the software may be explained in more detail.

Make more applications on real problems. Give homework to each student about their interests of faulting area.

I think that session in the morning would be good to explain the methodologies and examples. Session in the afternoon seems better for application.

You don't need any suggestions about it.

Not many, but you had better talk about what happens behind the screen [scene]. I mean the philosophy of calculation.

Your teaching is really good. And also your speech was so clear. No problem with understanding. The only problem in this course was time. One and a half day was not enough for me to catch the Coulomb. I would suggest to make the course time longer to practise and learn it well.

Keep up the good job!

Honestly I understood everything you told me. I think the course was good enough.

Giving more practicals.

2. *What suggestions do you have for improvements in the Coulomb software?*

It should be ported to the PC platform.

Make the program in such a way that it can be operated only with mouse clicks and no keyboard strokes.

Make the program more interactive, such that the effect of any modifications in the input can be immediately seen and quick/easy return to the original form.

Finally, make the program operable in WINDOWS, particularly using MATLAB (MATLAB has many tools for interactive graphics, for the visualization of vector fields, etc., and finally it is available for WINDOWS, Mac and UNIX environment). (We can cooperate in that issue if required…).

There should be more examples in the input file for the North Anatolian and the other fault types.

User interface menus for input may be modified for the ease of usage.

Make UNIX and Linux version.

My suggestion is related to preparing a version of Coulomb that will work under PC since especially Macintosh is rarely used in our faculty. I suggest that a program could be prepared to work via Internet, so it will be not problem whoever use which computers.

I hope the software can run on PC, Linux or Unix systems as soon as possible.

It is very user-friendly software.

I suggest to

-include a priori uncertainties for the initial fault parameters in order to calculate the output values (velocity, strain, stress, etc.) with their standard deviations which will ensure us to fit model and observation more correctly.

-include calculation of strain parameters from the original observations GPS, leveling, etc.).

The files may contain more choices like export to jpeg.

I hope that one day there can be a PC version in the future.

The version we used was quite capable and user-friendly despite a few minor problems (few crashes during the course). A PC version is a must (at least for Europeans). There are Mac platform emulators for PC around but ease of installation and stability are not guaranteed. We will try to test with these here due to lack of Macs in our faculty (only one at the moment).

There seemed to be some bugs in the open-windows (x) part of the software. But those made me think that they were related to some kind of ram-memory problems on each computer because the timings were different on each one (I mean processing on each Mac gave the same window error but in different times). Although this is a little bit annoying but, there's no problem with calculating the parameters, as you know. And I think this is the most important part of the subject ☺.

Direct plotting of stress change on receiving faults.

3. *Could you teach Coulomb to others at your institution after some more practice?*

Absolutely.

If necessary, I will be teaching this program.

Yes, I am willing to do so, very soon for our graduate students at Kandilli.

Since this subject is out of my professional scope, I don't think I will be teaching Coulomb.

Yes.

I have no Macintosh to repeat my experience but good familiarity. So, the facilities of computer is not suitable for teaching such a program under Macintosh. I believe that I could teach it if I have a version of PC. I appreciate very much to have a CD version of program working under PC. Would it be possible soon?

I think I can do it after some practice.

Of course.

Yes, especially the first part of the course related to horizontal and vertical fied [field] determination.

Sure but as you mentioned first I have to have good control on the programme.

After some more practice, yes, I would like to teach others (with your support of course).

I believe that I can teach Coulomb 2.0 easily, but I may not be able to answer questions from the students about "deep" theoretical details as Ross answered during the class.

As soon as I find a Mac, I'll do some practice. And if I can do this, why not? The students would love to use it. Especially the geophysicists.

Other comments:

That was a very fruitful two days for me… Thanks a lot.

I enjoyed meeting you and spending the two days together.

The time we spent in Ankara was really very fruitful and enjoyable. Thanks for everything.

Thank you so much to Ross and Shinji for organizing such a nice course. I appreciated it so much. And I hope such activities continue in the future.

Thank you and Shinji for sharing your knowledge on Coulomb with us!